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cians. The precise meaning in which concert pitch ought to be understood was then explained, as also the means by which instruments ought to be tuned to it.

Concert pitch is determined by the number of double vibrations which any string or pipe makes in a given time. The apparatus used by the author for ascertaining the number was then described: he described the means by which he attained a standard pitch. Some experiments were detailed, the calculations founded on them were entered into, and the results stated. The present concert pitch was shown to be at all times attainable and recoverable by throwing a steel wire of a certain length, diameter, and tension, into vibration, so that it shall quit and return to the point of inflection a certain number of times, within a given period.

Calculations and processes were then entered into, for obtaining the proper wire at all times, in case of its being no longer manufactured or sold. Means of proving or testing its qualities, and examples, were given. Necessity of great precision in these processes was proved by the instance of wires differing in diameter by the one-thousandth part of an inch, sounding notes which differed by very nearly a semitone. The errors of Mersenne in attributing the pitch of bells to their composition, and in estimating the effect of the component metals, were noticed. Similar mistaken notions were shown to have been acted on by the makers of piano-fortes.

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The Rev. Professor Dixon exhibited a model intended to illustrate the azimuthal motion of a freely suspended pendulum, of which he gave the following account:

“ This model is constructed on the principle, that we may consider the parallel of latitude, along which the point of suspension of the pendulum is carried by the diurnal rotation, to be made up of a number of elements, each of which coincides with the corresponding element of a great circle tangent to

the parallel, and consequently that the vertical passing through the point of suspension and centre of the earth may be conceived to move through a succession of small angles in a series of planes perpendicular to the axes of the great circles above referred to. These, which may be called *directive axes*, lie on the surface of a cone whose axis coincides with that of the earth, and whose angle equals twice the latitude. In the model, a graduated circle fixed on the vertical shows the deviation of the meridian from the plane of oscillation, after a period of time indicated by an hour circle attached in the usual way to the axis of rotation. If the successive positions of the directive axis were taken indefinitely near to one another, the expression for the azimuthal motion would be

$$A = H \sin \lambda,$$

where  $A$  is the angle made by the plane of oscillation with the meridian, after the earth has described the angle  $H$  round its axis, and  $\lambda$  is the latitude of the place of observation. The model is so constructed as to enable the directive axis to be placed in the positions it occupies at the termination of periods of half hours, and the error in the value of  $A$  produced by this approximation is so small as to be almost insensible on a model of the size of the present one, and much less than that necessarily arising from defects of construction."

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The Rev. Charles Graves, D. D., communicated a formula containing a symbol which denotes rotation through a given angle, and round a given axis, by means of rectangular co-ordinates and differential coefficients.

"Sir William Hamilton, by his calculus of quaternions, has arrived at a simple mode of denoting rotation round an axis.

"Using  $Q$  to denote the quaternion whose amplitude is  $\theta$ , and whose axis has given directive cosines, he finds that